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The objective of this work was to study tribomechanical property changes brought about by ion beam induced materials modification of the tribomechanical properties of ceramics.

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ION BEAM MODIFICATION OF CERAMICS: MECHANICAL PROPERTIES AND STRUCTURE

Final Report to the U.S. Army Research Office

January 12, 1993

Contract Number: DAAL03-89-K-0154 15 August 1989-14 August 1992

Submitted by: Cornell University
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Statement of the Problem Studied:

The objective of this work was to study tribomechanical property changes brought about by ion beam induced materials modification of the tribomechanical properties of ceramics.

Summary of Most Significant Results:

1) Implantation of various inert gases at low to medium energies into bulk zirconia improves hardness and tribomechanical properties. Further the hardness changes correlate with ion beam induced damage not dose.

2) MeV ion implantation of Au into bulk zirconia does improve the hardness in a similar fashion as the lower energy implants, but the effect on friction is negligible.

3) Solid Xe inclusions form when implanted into bulk zirconia at room temperature and liquid nitrogen temperature indicating that the Xe is under high pressure in the lattice. Along with solid Xe, liquid Xe was found as well. Similar results were obtained for ion implanted magnesia.

4) Bulk zirconia cannot be amorphized by an ion beam under any implant conditions.

5) Limited mixing via excimer laser processing of Ti into zirconia has been observed. Subsequent implantation with carbon gave a friction coefficient lower than untreated zirconia.

6) Carbon cannot be ion mixed with the bulk zirconia with 600 KeV Xe^{++}.

7) Ion implantation of Xe densifies sol-gel derived zirconia thin films.

PAPERS ACKNOWLEDGING ARO SUPPORT

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